

EXHIBIT A

COLOUR TELEVISION

Theory and Practice



S P Bali



Colour TV Receiver Controls

5

5.1 Introduction

There are three types of controls or adjustments in a TV receiver. In the first group come those controls which are accessible to and used by the viewer. These are called *user or customer controls*. The second group consists of those controls which the service technician adjusts while setting up the receiver in the customer's home. These *service controls* are usually located on the rear apron of the receiver. The third group includes the *alignment adjustments* for tuning of the frequency response and bandwidth of the RF, IF, sound IF and colour circuits. Proper alignment of these adjustments, which requires specialised knowledge and equipment, is usually done only in the service shop. The service adjustments made on the colour receivers are mainly concerned with the proper set up of the colour picture tube and also require special equipment.

Many colour receivers include *automatic circuitry*. This circuitry is usually activated by pushing a special button that is often designed to light up when it is engaged. The automatic circuits that can be switched in or out usually include automatic fine tuning, automatic tint, and preset controls for colour, tint, brightness and contrast. The *preset controls* are a duplicate set of controls for the same functions as the front-panel controls. They are preset at the factory or by a service technician to give an adequate picture in the normal reception conditions. It should be noted that a discerning viewer will often be able to obtain a better picture by careful adjustment of the *manual controls* than with the automatic preset system. The automatic button permits the less critical viewer to obtain a *usable picture quality*.

The classification of controls that follows is not rigid. Some controls listed in one category may fall into another category in some other receivers. In addition, many receivers will not have all the controls listed, while other receivers may contain controls not on the list.

5.2 Operating Controls Common to Black-and-White and Colour Receivers

So as to become familiar with the common controls, first turn the colour or chroma control fully counter clockwise, switching it off. This would eliminate all colour information from the screen. The adjustments now would be the same as of a black-and-white receiver.

The television viewer must be able to adjust the operating conditions of the receiver. The names of most user controls describe what they do, and this simplifies understanding their adjustment. Table 5.1 lists the operating controls a viewer may have to adjust in order to set up the television receiver for proper operation.

The operating controls are set up in the following way. The ON-OFF switch is turned to the ON position and the receiver is allowed enough time to warm up. The automatic control is set to OFF.

Table 5.1 Operating Controls

Control	Function	Location	Circuit Affected
1. On-Off	To turn power ON or OFF	Front panel, sometimes part of volume	Power supply
2. Volume	Control sound level	Front panel	Audio amplifiers
3. Brightness	Adjust CRT light output	Usually front panel	CRT bias
4. Contrast	Adjust ratio of black to white on CRT	Front or rear panel	Video amplifiers
5. Channel selector	Tune in station	Front panel	Front end
6. Fine tuning	Exact station setting	Front panel	RF oscillator
7. Horizontal hold	Lock picture horizontally	Front or rear panel	Horizontal oscillator frequency
8. Vertical hold	Lock picture vertically	Front or rear panel	Vertical oscillator frequency
9. Tone	Audio-frequency response	Front panel	Audio amplifiers
10. Automatic	Simple adjustment (see text)	Front panel	Many (see text)
11. Video peaking	Sharpen picture detail	Front or rear panel	Video amplifiers
12. Colour	Adjust colour intensity	Front panel	Chroma amplifier
13. Tint	Adjust to correct shade of colour	Front panel	4.43 MHz phase

The volume control is adjusted for the presence of some sound. The brightness control is set to show a raster on the picture tube. The channel selector is then switched ON to bring in the desired station, and the fine tuning is adjusted to bring in the best picture and sound. In colour receivers, the setting of the fine tuning is critical. Slight misadjustment can cause loss of colour or a severe beat. Many receivers now include AFT (Automatic Fine Tuning) to eliminate this problem. If multiple lines or an unsynchronized picture appears, the vertical hold is adjusted to stop any up-and-down motion. Similarly, the horizontal hold is adjusted to eliminate horizontal or diagonal bars. The *level* of the operating controls such as brightness and contrast should then be readjusted to give the desired picture and sound. The initial and final touch-up adjustments may be made in any sequence.

In some colour receivers, there are additional user controls to adjust picture and sound. These may include tone and video peaking. The tone control varies the sound frequency response, emphasizing either high (treble) or low (bass) frequencies. The video peaking control emphasizes or reduces the high-frequency response of the video circuits in the receiver. For strong signals, emphasized high frequency results in crisp, sharp pictures. On weak or fringe signals, minimum high-frequency response, within the range of the video peaking control, reduces noise in the picture.

5.3 Common Service Controls for Black-and-White and Colour Receivers

Television service technicians must adjust many different types of television receiver controls. Understanding the circuits and the function of each control will help technicians to make proper adjustments. Since you are not expected to adjust these controls properly or to be familiar with receiver circuitry at this point, Table 5.2 is to be referred to for information on the effects of the service controls. This table lists most *service controls* with a general description of their *function* and of the *circuits affected*.

A number of precautions should be observed at all times while working on a television receiver with the power ON. The high-voltage cage should always be closed and any shield around the

Table 5.2 Service Controls (Common to Black-and-White and Colour Receivers)

Control	Function	Circuit Affected
1. Circuit breaker	Reconnect B+ after overload	Power supply
2. Automatic gain control	Set level of detector output	RF and IF bias
3. Vertical size (height)	Height of raster (bottom)	Vertical sweep output
4. Vertical linearity	Equalize height near top and bottom of raster	Vertical output stage bias
5. Width	Horizontal raster size	Horizontal output transformer
6. Horizontal linearity	Equalize width of left and right side (adjust efficiency)	Damper waveform controls output current
7. Brightness range	Adjust operation of front-panel control	Voltage applied to brightness control
8. Noise inversion	Optimize sync for available signal strength	Bias on noise inverter
9. Vertical centering	Position raster vertically	Control of electron beam (vertically)
10. Horizontal centering	Position raster horizontally	Control of electron beam (horizontally)
11. Focus	Sharpen the raster lines	Control to narrow electron beam
12. Pincushion adjustment	Straighten raster lines	Electric or magnetic control of raster edges (usually top and bottom)
13. Normal-raster-service switch	Aid in colour CRT setup <i>Must be in normal position to get a usable picture</i>	AGC and vertical sweep circuit

regulator must be in place. The high-voltage lead from the cage to the CRT must be well insulated and dressed out of the way, since voltages of 30,000 V are now quite common in the colour receivers. Most black-and-white receivers have about 20,000 V for the sets using large picture tubes and about 10,000 V for smaller ones.

The picture tube is a highly evacuated tube and requires careful handling. Accidentally hitting the tube with a tool, scratching it, dropping it, or any sharp contact with it may cause it to implode. Such an implosion causes glass fragments to fly around with great force and can cause considerable damage and physical injury. Many modern picture tubes have some form of *integral implosion protection*. This can be an epoxy-attached faceplate, a metal shell attached near the front, a tension band near the front of the tube, etc. None of these systems must ever be tampered with or removed and such a CRT must never be replaced with an unprotected tube.

5.4 Colour Operating Controls

In addition to the controls normally found in a black-and-white set, the colour receiver has two operating controls for the colour rendition of the picture. The colour control, sometimes called *chroma* or *saturation control*, adjusts the amount of colour information in the scene. With the control fully counter clockwise, the picture turns black-and-white. As the control is rotated clockwise, the picture goes from delicately tinted shades, through stronger pastel shades, to bright colours and finally to colour overload manifest as an iridescent appearance and streaking.

The second control is the *tint* or *hue control*. This control changes the actual hue or colour of the scene.

The most readily available reference colour on the screen is the flesh colour. In most receivers, turning the tint control counter clockwise from its center position will make the flesh tones magenta